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EFFECT OF SULPHUR QUANTITY AND TIME OF APPLICATION ON YIELD , BULB QUALITY AND STORABILITY OF GARLIC UNDER DRIP IRRIGATION SYSTEM IN SANDY SOIL

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ABSTRACT:

Two field experiments were conducted during the two successive winter seasons of 2006/2007 and 2007/2008 in the Vegetable Private Farm at El-Khattara village, Sharkia Governorate to evaluate the effect of sulphur quantity and its application time, on yield, quality and storability of garlic under sandy soil conditions using drip irrigation system. This experiment included ten treatments, as follows : (1) Control (without sulphur), (2) 100 kg S/fed at soil preparation (SP), (3) 200 kg S/fed at SP, (4) 300 kg S/fed at SP, (5) 100 kg S/fed as 50 % at SP+50 at 30 days after planting (DAP), (6) 200 kg S/fed as 50 % at SP+50 at 30 DAP, (7) 300 kg S/fed as 50 % at SP+50 at 30 DAP, (8) 100 kg S/fed as 50 % at SP+25 at 30 DAP+ 25 at 60 DAP, (9) 200 kg S/fed as 50 % at SP+25 at 30 DAP+ 25 at 60 DAP, (10) 300 kg S/fed as 50 % at SP+25 at 30 DAP+ 25 at 60 DAP.

All applied sulphur quantity at different tested application times and doses had significant enhancing effect on garlic plant growth (roots, bulb, leaves and total dry weights/ plant), plant nutrients uptake and bulb quality at harvesting time (total carbohydrate, total sugars, S, DM volatile oil and pungency percentages in bulbs) comparing to unfertilized control plants. Also, sulphur fertilized plants resulted bulbs able to store for long times with minimum percentages of emaciation, sprouting and weight loss during storage period as compare to bulbs resulted from unfertilized plants. The superior treatment which resulted the highest values represented bulb yield of grade 1, 2, exportable, marketable, and total yield /fed as well as average bulb weight was 200 kg S/fed as 50 % at SP + 50% at 30 DAP. It recorded 27 and 29 % increases in total yield over control treatment during the two tested seasons, respectively. The highest sulphur use efficiency (SUE) as Kg bulb production/ Kg S fertilizer was recorded under treatments effect of 100 Kg S/ fed as 100 % at SP or 200 kg S /fed as 50 % at SP + 50 % at 30 DAP.

Key words: Garlic, sulphur quantity, application time, yield, SUE, pungency, volatile oil, storability**.**

INTRODUCTION

Garlic (*Allium sativum*, L.) is one of the oldest cultivated vegetables. Its medicinal effects has proved from thousands years. The edible part of garlic plant is the garlic cloves. Garlic contains antibiotics of garlicin and allistatin, number of enzymes, amino acids and trace elements. It is eat directly or adds to food for its flavor. Also, it is used in preparation of smoked-meat products and in some medicaments. Nowadays it is valued for its essential oil contents (Mal? *et al.* 1998).

During the least few years, the area devoted for the cultivation was rapidly extended especially in newly reclaimed soils. These soils contain relatively high salts and high pH. Such conditions reduce garlic yield and other vegetables. Sulphur applications frequently reduced soil pH, thus it increased availability of the most nutritional elements. Additionally, lowering pH can increase assimilation of nutrients as well as promote $SO4^{-}$ ions uptake through preventing their leaching (Hilal *et al.* 1990). Sulfur is an essential nutrient element for plant growth. The majority of sulfate taken up by plant is incorporated in cysteine and methionine amino acids which are highly important in proteins and enzymes synthesis (Haneklaus *et al.*, 1997).

According to Beaton (1966), garlic and onion plants need more sulphur supplying than other crops for its important role in plant growth and synthesis of volatile oils. Many researchers supported this concept, Khalaf and Taha, 1988; Singh *et al.*, 1995 ; Mee *et al.*, 1997 ; El-Morsy, 2005; Losak and Winiowska-Kielian, 2006 and Farooqui *et al.*, 2009 published that sulphur fertilization enhanced garlic plant dry weight and its cloves yield. Also, contents of garlic bulbs of TSS % and volatile oil as well as bulb storability were increased by sulphur fertilization (El-Morsy, 2005). As for garlic bulb chemical composition, Abd El-Hameed (1998) found that adding sulphur at 300 kg/*fed* as 50 % pre + 50 % post planting significantly increased N, P and K percentages in bulbs.

However, the aim of the present study was to evaluate to what extant sulphur applications (adding quantity and application time) overcome sandy soil conditions under drip irrigation system for enhancing garlic production and its storability.

MATERIALS AND METHODS

Two field experiments were carried out during the two successive winter seasons of 2006-2007 and 2007-2008 in the vegetable private farm at EL-Khattara village , Sharkia Governorate to evaluate the effect of sulphur quantity and time of application on garlic bulb production, quality and its storability under sandy soil conditions using drip irrigation system.

The used soil properties were: sandy soil in texture for the two experimental seasons, while it had 0.06 and 0.04 % organic matter, 8.27 and 8.22 pH, 2.10 and 2.14 mmhos/cm EC, 3.73 and 3.32 ppm available N, 3.23 and 3.97 available P and 10.17 and 10.28 available K during the 1st and 2nd seasons, respectively.

This experiment included ten treatments as follows:

1- Unfertilized plants (Control).
2- 100 kg sulphur/ *fed* at soil preparation (SP).
3- 200 kg sulphur/ *fed* at SP.
4- 300 kg sulphur/ *fed* at SP.
5- 100 kg sulphur/ *fed* as 50 % at SP + 50 % at 30 days after planting (DAP).
6- 200 kg sulphur/ *fed* as 50 % at SP + 50 % at 30 DAP.
7- 300 kg sulphur/ *fed* as 50 % at SP + 50 % at 30 DAP.
8- 100 kg sulphur/ *fed* as 50 % at SP + 25 % at 30 DAP + 25 % at 60 DAP.
9- 200 kg sulphur/ *fed* as 50 % at SP + 25 % at 30 DAP + 25 % at 60 DAP.
10-300 kg sulphur/ *fed* as 50 % at SP + 25 % at 30 DAP + 25 % at 60 DAP.

The Experimental layout was as a simple experiment, and the treatments were arranged in a randomized complete block design with three replicates. The experimental unit area was 12.6 m^2. It was contained three dripper lines with 7 meter length and 60 cm in width. Plants of one dripper line were used as samples for measuring vegetative growth characteristics and plant uptake of N, P and K, while plants of the two other dripper lines were used for yield determinations.

Cloves of garlic Balady cultivar (local cultivar in Egypt) were used in this study. Cloves were selected for its uniformity in shape and size. Then, they were sown on both line dripper sides at distance of 7.5 cm apart. Sowing was done on September 15th during the two tested seasons.

All experimental units received equal amounts of commercial fertilizers; *i.e.*, ammonium sulfate (20.6%N), calcium superphosphate (15.5%P_2O_5) and potassium sulfate (48%-52% K_2O) at the recommended doses of N, P and K (120, 90 and 100 kg /*fed*, respectively). Farmyard manure at 30 m^3/ *fed* beside one third of both ammonium sulfate and potassium sulfate as well as all amount calcium superphosphate fertilizers were added in the center of rows and covered by sand during soil preparation. The rest of amounts of N and K fertilizers were added through irrigation water (fertigation) in 7 days intervals beginning one month after planting. All normal agricultural practices were carried out when ever needed as commonly followed in district.

Data Recorded

Plant growth determinations and contents of N, P and K in different plant organs were recorded at 135 days after planting, while bulb yield and its components as well as bulb quality parameters were determined at harvesting (215 days after planting on April 20th) for the two tested seasons.

1. *Plant growth*:

Ten plants were randomly taken for each plot, and they were divided separately into different organs; *i.e.*, roots, leaves and bulbs, then they were oven dried at 70 °C tell constant weight. Plant growth was recorded as leaf, root and bulb dry weights/ plant (g). In addition, total plant dry weight (roots + bulb +leaves/ plant) was calculated.

2. Uptake of N, P and K in different plant organs and total uptake by plant:

Dried represented samples of roots, leaves and bulbs of the all tested treatments in the second season (2007/2008) were finely ground and wet digested. Then, N, P and K contents were determined according to the methods described by Bremner and Mulvaney (1982), Olsen and Sommers (1982) and Jackson (1970), respectively. The uptake of minerals and total plant uptake were calculated.

3. Yield and its components:

At proper maturity stage of bulbs (215 days after planting), bulbs in every plot were harvested and graded into four categories according to the Ministry of Economic for garlic exportation (1963) as follow: grade 1: Bulbs with diameter above 5.5 cm, grade 2: Bulbs with diameter between 4.5- 5.5 cm, grade 3: Bulbs with diameter between 3.5- 4.4 cm, and grade 4: Bulbs with diameter less than 3.5 cm. Then, each grade was weighed separately at the same harvest day and the following data were calculated as ton/ *fed*: exportable yield (grade 1+grade 2), marketable yield (grade 1 + grade 2 + grade 3), and total yield (grade 1+ grade 2 + grade 3 + grade 4). Also, average bulb fresh weight (gm) was recorded.

4. *Sulphur use efficiency (SUE*):

It was calculated according to equation of Bharathi and Poongothai (2008) as follows:

$$SUE = \frac{\text{Yield of S applied - Yield of control}}{\text{S (kg /fed)}} = \text{yield kg/kg S}$$

5. Bulb quality at harvesting:

Evaluation bulb quality was done just after harvesting, the evaluation implicated determination characteristics of bulb tissues of total carbohydrate (%) according to the method described by Dubois *et al*. (1956), total soluble sugar according to Forsee (1938), sulphur percentage according to Cotteni *et al*. (1982). Also, pungency as pyruvic acid was determined in fresh garlic cloves tissues using the method described by Schwimmer and Westen (1961). Additionally, bulb content of total soluble solids (TSS) was measured using Carl Zeis refractometer set and Dry matter (%) in bulb was determined.

Volatile oil was determined in fresh bulb tissues by water distillation. The condensed volatile oil was collected using separating funnel and then measured as cm^3/kg fresh weight according to Farag,(1986).

6. Bulb Storability:

Just after harvesting on April 20th for the two experimental seasons, bulb yield of each plot was separately collected and translocated to curing for twenty days in aired shady place. After curing (on May 10th) , drayed plant tops were discarded and four kilograms of uniform cured bulbs for each plot were putted in palm crates and then stored at room temperature. Storage was prolonged to ten months, so the storage zero time was May 10th and it was ended on March 10th in both seasons. The average room temperature and relative humidity during storage months are presented in Table 1.

Table1.The average room temperature (°C) and relative humidity (%) during storage months

Months	Temperature		Relative humidity	
	1st Season	2nd Season	1st Season	2nd Season
May	29	28	64	56
June	30	28	59	57
July	32	32	60	60
August	33	32	60	59
September	29	29	58	64
October	25	27	68	63
November	23	21	75	73
December	18	18	71	71
January	20	17	56	62
February	17	16	62	53
March	20	21	61	58

Bulb storability was tested by monthly recording the following data:

1. ***Emaciation (%);*** observations on emaciation (empty cloves) were recorded based on visual examination of stored bulbs.
2. ***Sprouting (%):*** It was estimated and expressed as percentage of sprout bulbs, and then the cumulative sprouting percentage was calculated.
3. ***Weight loss (%):*** Bulbs of each treatment were weighed at 30 days intervals, and then the cumulative weight loss percentage was calculated.

The first visual recognized signs of emaciation and sprouting were observed after 210 days from the beginning of storage period.

Statistical Analysis:

Recorded data were subjected to the statistical analysis of variance according to Snedecor and Cochran (1980), and means separation were done according to Duncan **(1955).**

RESULTS AND DISCUSSION

1-Plant growth:

Data in Table 2 reveal that, generally, all applied sulphur quantity at different tested application times had significant enhancing effect on garlic plant growth determined as: roots, bulb, leaves and total dry weights/ plant comparing to untreated control plants during the two growing seasons. However, plants received 200 kg/ *fed* as 50 % at soil preparation (SP) + 50 % at 30 days after planting (DAP) was the superior in all recorded growth parameters with an exception of root dry weight in the 1st season. The increases in total dry weight/ plant under the effect of

this treatment about 74 and 60 % over the control in the 1st and 2nd seasons. These results coincided with those reported by Khalaf and Taha (1988), Fayed (1998), El-Morsy (2005) and Farooqui *et al*. (2009). Also, previous researchers proved the essential role of sulphur in plant nutrition. Sense, it incorporated in sulphur containing amino acids. Overall increases in growth attributes may be due to that sulphur increased root system growth which in turn enhanced nutrients uptake and the other dependent physiological processes like photosynthesis (Jaggi , 2004).

2- Uptake of N, P and K in different plant organs:

Sulphur fertilizer applications at different tested times and doses significantly enhanced roots, leaves, bulb as well as total garlic plant uptake of N, P and K (Table 3). Adding 200 kg S/*fed* as 50 % at SP + 50 % at 30 DAP recorded the maximum values of N, P and K uptake in roots. Whereas 200 or 300 kg S/*fed* as 100 % at SP recorded the maximum values of N, P and K uptake in bulb. As for leaves uptake, 200 or 300 kg S/*fed* as 100% at SP or 200 kg S/*fed* as 50 % at SP + 50 % at 30 DAP significantly increased N, P and K uptake as compare to the other treatments. Also, data of the same Table 3 reflect that 200 or 300 kg S/ *fed* at SP or 200 kg S/ *fed* as 50 % at SP + 50 % at 30 DAP treatments which enhanced N, P and K uptake in different plant organs also increased total plant uptake of these elements comparing to other treatments with insignificant differences between them. Similar results were previously recorded respecting N, P and K uptake of garlic bulbs (Singh *et al*., 1995 and Abd El-Hameed, 1997), leaves and total plant uptake (Fayed, 1998 and El-Morsy, 2005). However, the increments in nutrients uptake under sulphur treatments might be resulted from sulphur role in adjusting sandy soil pH which increased nutrient availability and in turn reflected as more nutrient uptake and plant growth (Mehana and Farag, 2000).

3- Yield and its components as well as sulphur use efficiency (SUE):

Data presented in Tables 4 show that, generally, sulphur application quantities at different tested times extracted significant increments on yield of grades 1, 2, 3 and 4, exportable, marketable and total yield/*fed* as well as average bulb weight comparing to control in both seasons. The superior treatment which resulted the highest values represented yield of grade 1, 2, exportable, marketable, and total yield /*fed* as well as average bulb weight was 200 kg S/*fed* as 50 % at SP + 50% at 30 DAP. It recorded 27 and 29 % increases in total yield over control treatment during 1st and 2nd seasons, respectively. This results might be due to the favorable effect of S at 200 kg/*fed* as 50 % at SP + 50 % at 30 DAP on dry weight (Table, 2) N, P and K total uptake (Table 3) and average bulb weight (Tables 4) and this in turn increased total garlic bulb yield.

Respecting sulphur use efficiency (SUE), data of the same Table 4 reflect that the highest SUE values as Kg bulb production/ Kg S fertilizer were recorded under the effect of 100 Kg S/ *fed* as 100 % at SP or 200 kg S /*fed* as 50 % at SP + 50 % at 30 DAP applications in both seasons. The former treatment recorded 11.2

and 9.1 kg bulb/ kg S, while, the later one resulted 11.1 and 12.4 kg bulb/ kg S in the 1st and 2nd seasons, respectively. In general, SUE decreased with dividing the applied sulphur quantity; *i. e.,* adding the same sulphur quantity as three doses (50 % at SP + 25 % at 30 DAP + 25 % at 60 DAP) decreased SUE comparing to the addition as one (at SP) or two (50 % at SP + 50 % at 30 DAP) doses. This was confirmed during the two seasons. However, this result may be due to that these treatments increased total uptake of N, P and K (Table 3) and in turn increased garlic plant sulphur use efficiency. According to Misra (2003) the increases in bulb yield due to S fertilization might be due to the stimulatory effect of applied S in chloroplast and protein synthesis, so its activation role in photosynthesis and the other metabolic processes. Results of such research were in accordance with these obtained by Abd El-Hameed, (1997) and Mee *et al.* (1997) respecting S effects on average garlic bulb weight and total yield. Also, El-Morsy, (2005) and Farooqui *et al.*, (2009) published that S at 60 kg S ha^{-1} significantly increased number of cloves per bulb, fresh weight of 20 cloves, average fresh weight of bulb and bulb yield q/ ha^{-1} comparing to lower sulphur doses of 20 and 40 kg/ha.

4- Bulb quality:

Generally, all sulphur treatments significantly increased bulb quality determined as: percentages of total carbohydrates, total sugar, sulphur (S), total soluble solids (TSS), and dry mater (DM) as well as pungency (µ mol/ g FW) and volatile oil (cm^3/ Kg FW) in harvested bulb tissues comparing to control plants (Table 5). The highest values of total carbohydrate, total sugars, S, DM and volatile oil were recorded in bulbs harvested from plants which fertilized with 300 kg S/*fed* as 50 % at SP + 25 % at 30 DAP + 25 % at 60 DAP. While, the highest pungency (pyrovic acid) and TSS were resulted under the treatment effect of 200 or 300 kg S/*fed* as 50 % at SP + 50 % at 30 DAP as compare to control and the all other sulphur treatments. These results implicate that there are positive interrelationships between total carbohydrates, total sugars, DM and volatile oil in garlic bulb tissues on one side and S contents on the other side. Marschner (1995) published that plants take up sulphur particularly as sulphates through the soil solution; after its reduction in the plant tissues, it inters in various primary and secondary compounds, such as cystein, methionine or essential oils of the alline and allicin type (Haneklaus *et al.*, 2007). However, Randle and Lancaster (2002) recorded significant differences in flavour and pungency related to the differences in sulphur uptake as well as in essential components of the sulphur metabolic pathway. Also, El-Morsy (2005) found that sulphur significantly increased TSS and volatile oil percentages in garlic cloves.

5. Storability

Emaciation, sprouting and weight loss percentages of garlic bulbs at thirty days intervals during the storage period of 300 days are recorded in Tables 6, 7 and 8, respectively.

Sulphur fertilized plants resulted bulbs able to storage for long period with lower emaciation percentage than bulbs of unfertilized ones. Since, S fertilization at different tested quantities and application times significantly reduced bulb emaciation during storage period especially at 270 and 300 days from the beginning of storage comparing to bulbs of control plants during the two seasons. Generally, the superior treatments in this respect were 200 kg S/*fed* as 50 % at SP + 50 % at 30 DAP or 300 kg S/*fed* as 50 % at SP + 25 % at 30 DAP + 25 % at 60 DAP without significant differences between them (Table 6).

As for sprouting (Table 7), the confirm results during the two seasons were that unfertilized control plants resulted in the highest sprouting % at different recorded storage times comparing to the all other treatments. Sprouting was initiated in bulbs at 210 days from the beginning of storage and its percentage was increased with prolonging the storage period up to 300 days. This might be attributed to low temperature and high relative humidity in air condition of storage room during Nov. to Feb. (Table 1) and this in turn enhance sprouting processes of cloves.

Generally, bulb weight loss percentage (Table, 8) was increased with increasing storage period. Sulphur applications at different doses and times significantly decreased bulb weight loss during storage period compared to control. Treatment of 300 kg S/*fed* as 50 % at SP + 25 % at 30 DAP + 25 % at 60 DAP recorded the minimum weight loss percentages in stored bulbs compared to the all other treatments. However, increasing bulb weight loss with increasing storage period might be attributed to the high air temperature of storage room during June to September (Table 1) and this in turn might increased weight loss through evaporation and dry matter loss through respiration. El-Morsy (2005) found that TSS (%) and volatile oil in garlic bulbs was increased with increasing S application, whereas weight loss (%) in bulbs decreased with increasing S application.

Conclusively, from the foregoing results, it could be conclude that sulphur fertilization had an enhancing effect in improving garlic growth and its nutrients uptake under sandy soil conditions, so it increased bulb yield, quality and storability. Appling sulphur at 200 kg/*fed* as: 50 % at soil preparation + 50 % at 30 days after planting was the superior treatment for enhancing yield and its components. Also, the same treatment significantly reduced bulb emaciation, sprouting and weight loss during storage period as compare to bulbs resulted from unfertilized control plants.

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تأثير كميات ومواعيد اضافة الكبريت على محصول وجودة الأبصال والقدرة التخزينية للثوم تحت نظام الرى بالتنقيط فى الأرض الرملية

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أجريت تجربتان حقليتان خلال موسمى شتاء ٢٠٠٦/٢٠٠٧ ، ٢٠٠٧/٢٠٠٨ وذلك فى مزرعة خضر خاصة- بقرية الخطارة- محافظة الشرقية، وذلك بهدف دراسة تأثير كميات ومواعيد إضافة الكبريت على المحصول والجودة والقدرة التخزينية للثوم تحت ظروف الأرض الرملية وباستخدام نظام الرى بالتنقيط. وقد اشتملت التجربة على ١٠ معاملات كالتالى : (١) معاملة الكنترول (بدون إضافة) ، (٢) إضافة ١٠٠ كجم كبريت/فدان دفعة واحدة أثناء إعداد وتجهيز الأرض للزراعة، (٣) إضافة ٢٠٠ كجم كبريت/فدان دفعة واحدة أثناء إعداد وتجهيز الأرض للزراعة، (٤) إضافة ٣٠٠ كجم كبريت/فدان دفعة واحدة أثناء إعداد وتجهيز الأرض للزراعة، (٥) إضافة ١٠٠ كجم كبريت/فدان على دفعتين ٥٠ % أثناء إعداد وتجهيز الأرض للزراعة+ ٥٠ % بعد ٣٠ يوم من الزراعة، (٦) إضافة ٢٠٠ كجم كبريت/فدان على دفعتين ٥٠ % أثناء إعداد وتجهيز الأرض للزراعة+ ٥٠ % بعد ٣٠ يوم من الزراعة، (٧) إضافة ٣٠٠ كجم كبريت/فدان على دفعتين ٥٠ % أثناء إعداد وتجهيز الأرض للزراعة+ ٥٠ % بعد ٣٠ يوم من الزراعة، (٨) إضافة ١٠٠ كجم كبريت/فدان على ٣ دفعات ٥٠ % أثناء إعداد وتجهيز الأرض للزراعة+ ٢٥ % بعد ٣٠ يوم من الزراعة +٢٥ % بعد ٦٠ يوم من الزراعة، (٩) إضافة ٢٠٠ كجم كبريت/فدان على ٣ دفعات ٥٠ % أثناء إعداد وتجهيز الأرض للزراعة+ ٢٥ % بعد ٣٠ يوم من الزراعة +٢٥ % بعد ٦٠ يوم من الزراعة(١٠) إضافة ٣٠٠ كجم كبريت/فدان على ٣ دفعات ٥٠ % أثناء إعداد وتجهيز الأرض للزراعة+ ٢٥ % بعد ٣٠ يوم من الزراعة +٢٥ % بعد ٦٠ يوم من الزراعة

كان لإضافة كل كميات الكبريت بمختلف مواعيد الإضافة تأثير معنوى على نمو نبات الثوم (الوزن الجاف لكل من الجذور ، البصلة ، الأوراق ، الوزن الجاف الكلى للنبات) ، الممتص من العناصر بواسطة النبات ، جودة الأبصال عند الحصاد متمثلا فى النسبة المئوية لمحتوى الأبصال من الكربوهيدرات الكلية ، السكريات الكلية ، الكبريت ، المادة الجافة ، الزيت الطيار ،وكذلك الحرافة ، مقارنة بالنباتات غير المعاملة (الكنترول) . أيضا سجلت النباتات التى تم تسميدها بالكبريت أبصال ذات مقدرة عالية على التخزين متمثلا فى تناقص نسب كل من التفريغ ، التزريع وكذلك الفقد الكلى فى الوزن مقارنة بمعاملة (الكنترول). كانت أفضل المعاملات للحصول على أعلى القيم لكل من محصول الدرجة الأولى ، الثانية ، المحصول المصدر والقابل للتسويق ، المحصول الكلى للفدان ، وكذلك متوسط وزن البصلة بتسميد نباتات الثوم بالكبريت بمعدل ٢٠٠ كجم/فدان مقسمة على دفعتين ٥٠ % أثناء إعداد وتجهيز الأرض للزراعة + ٥٠ % بعد ٣٠ يوم من الزراعة والتى سجلت زيادة مقدارها ٢٧ ، ٢٩ % فى المحصول الكلى عن معاملة الكنترول خلال موسمى الزراعة على التوالى. سجلت أعلى كفاءة لاستخدام الكبريت (كجم أبصال منتجة /واحد كجم كبريت) وذلك باستخدام معاملة التسميد بالكبريت بمعدل ١٠٠ كجم/فدان عند إضافتها مرة واحدة أثناء إعداد وتجهيز الأرض للزراعة، أو ٢٠٠ كجم/فدان عند تقسيمها على مرتين (٥٠ % أثناء إعداد وتجهيز الأرض للزراعة +٥٠ % بعد ٣٠ يوم من الزراعة).